

If you are ever at a loss to support a flagging conversation, introduce the subject of eating.

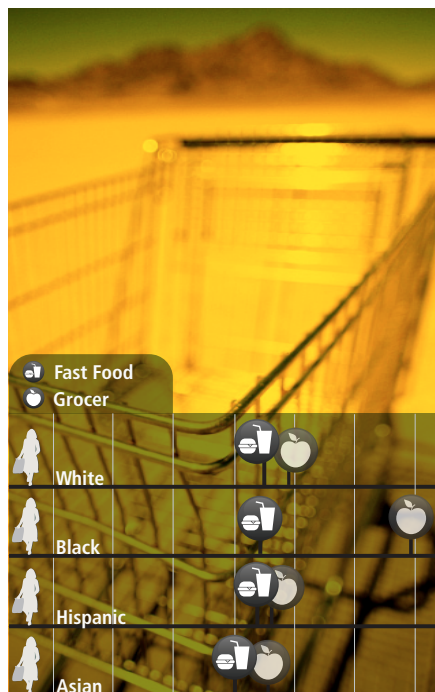
Leigh Hunt, poet (1784–1859)

## DIET AND NUTRITION

# White House Proposes Healthy Food Financing Initiative

The Obama administration announced in February a \$400 million initiative it hopes will lure retailers of healthy foods into the so-called food deserts of America. The program, proposed as part of the fiscal year 2011 budget, aims to boost public health by eliminating urban and rural food deserts within 7 years.

The term “food desert” refers to areas that, although often served by fast food restaurants and convenience stores, lack easy access to affordable fruits, vegetables, whole grains, low-fat milk, and other foods that make up the full range of a healthy diet. About 23.5 million people—including 6.5 million children—live in low-income areas that are more than 1 mile from a supermarket, according to the June 2009 report *Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences* by the U.S. Department of Agriculture (USDA).



In a study of Chicago food deserts, black residents had to travel farther than other racial groups to reach a grocery store but not a fast food restaurant.

Distance shown in tenths of a mile. Adapted from Mari Gallagher Research & Consulting Group. 2006. Examining the impact of food deserts on public health in Chicago.

The new Healthy Food Financing Initiative (HFFI) would be administered jointly by the Departments of Health and Human Services, Agriculture, and the Treasury, and would dovetail with Michelle Obama's recently announced “Let's Move” campaign to end childhood obesity within a generation. It would emphasize provision of fresh produce. And although the primary goal is nutrition, it would also seek to “create jobs and economic development, and establish market opportunities for farmers and ranchers,” said agriculture secretary Tom Vilsack at the program's announcement.

That is what a Pennsylvania program, a model for the HFFI, has done, says Ann Wright, the USDA deputy undersecretary for marketing and regulatory programs. Launched in 2004, the Pennsylvania Fresh Food Financing Initiative has opened about 80 stores ranging from small mom-and-pop grocers to large full-service supermarkets, providing food for around 400,000 people, says John Weidman, deputy executive director of The Food Trust (TFT), 1 of 3 nonprofits managing the program. The program also has provided jobs for 4,800 people, he says.

The public health problem these programs address is obvious but imprecisely defined. Many of the highly processed, fat- and sugar-rich foods sold at convenience stores and fast food restaurants are implicated in cardiovascular disease, diabetes, and cancer. Several studies have reported that easy access to healthy foods and limited access to convenience stores is associated with healthier eating and reduced obesity, according to a review by Nicole Larson et al. in the January 2009 issue of the *American Journal of Preventive Medicine*.

However, the actual health toll from living in a food desert environment has not been tabulated in a peer-reviewed study. Moreover, the only 2 studies that examined diets before and after grocery stores were installed in food deserts—rather than comparing neighborhoods with grocery stores to similar neighborhoods without—are not encouraging, says Steven Haider, an associate professor of economics at Michigan State University. Neil Wrigley et al. wrote in volume 35, issue 1 (2003) of *Built Environment* that people consumed an extra half a serving of fruit and/or vegetables daily, while Steve Cummins et al. reported no change in the Winter 2005 issue of *Planning Healthy Towns and Cities*. And global nutrition professor Barry Popkin of the University of North Carolina at Chapel Hill says a January 2009 workshop he chaired at the Institute of Medicine on the public health effects of food deserts “could find no evidence that adding new retail stores to depressed areas changed what people consumed.”

Meanwhile, Amy Lanou, an assistant professor of health and wellness at the University of North Carolina at Asheville, argues that education, a demand-side measure, is needed to maximize the benefits of the HFFI. (Demand-side measures are measures that boost peoples' desire to purchase healthy food. Their converse, supply-side measures, are those, such as grocery stores, that make it more available.) Wright says the USDA has been promoting better nutrition in schools through agency programs and support for local efforts to bring healthy food into the school cafeteria. But while school lunches must meet specific nutritional requirements, Lanou says schools “can sell almost anything à la carte,” giving kids the option of eating unhealthily if they can afford it.

Mari Gallagher, whose eponymous research and consulting company has studied food deserts extensively in Chicago and other cities, says it's not enough to live near healthy food outlets. People who are time-stressed—working multiple jobs, for instance, or commuting on several different transit lines—will travel half a mile for junk food rather than a mile for healthy food, she says.

If access to affordable wholesome food alone does not alter eating habits, perhaps other factors will. In the 8 March 2010 issue of *Archives of Internal Medicine*, Popkin showed that localized hikes in fast food prices over a 20-year period tracked with reduced risk of obesity and diabetes in affected communities. Another study finds cultural sensitivity is important in promoting healthy eating. “Our qualitative research in New York City suggests that Hispanic immigrants conceptualize ‘healthy foods’ more in terms of freshness and local origin than in terms of nutritional content,” says Andrew Rundle, an associate professor of epidemiology at the Mailman School of Public Health, Columbia University. This is consistent, he says, with initial findings in Hispanic neighborhoods that access to farmers' markets was a better predictor of produce consumption than access to supermarkets.

Gallagher warns that determining which locales have the greatest need for subsidies, as well as keeping politics from affecting the flow of money, will be challenging. It is important to “make sure we're armed with neutral data that directs the flow of resources,” she says. Nonetheless, she says, “I'm very thrilled [about the proposed initiative]. We think this is needed. We encourage the administration to disburse these funds with the best data and methods so we get the highest public health return for the investment.”

David C. Holzman writes on science, medicine, energy, economics, and cars from Lexington and Wellfleet, MA. His work has appeared in *Smithsonian*, *The Atlantic Monthly*, and the *Journal of the National Cancer Institute*.

Joseph Turf/EHP

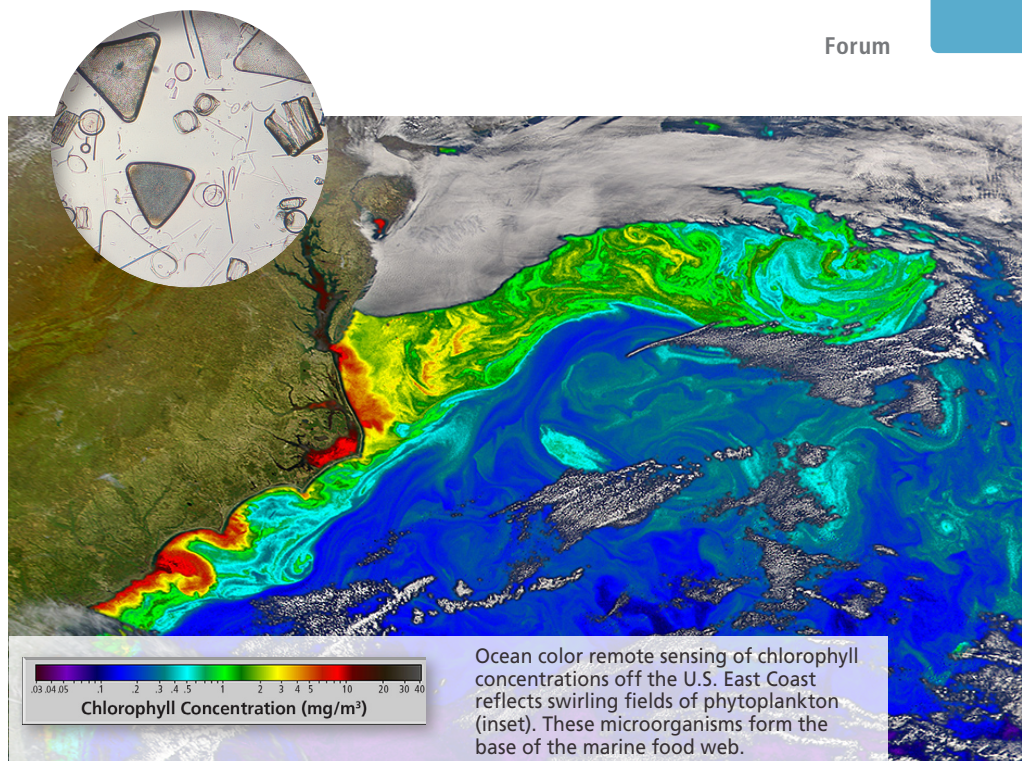
## MARINE AND COASTAL SCIENCE

# Will Ocean Acidification Erode the Base of the Food Web?

Acidification of the world's oceans is already damaging coral reefs and could produce other unexpected chemical and biological consequences. Princeton University researchers now report that at low pH, phytoplankton take up less iron, a key nutrient needed for photosynthesis and growth. The results, reported in the 5 February 2010 issue of *Science*, suggest ocean acidification could have a profound impact on these tiny one-celled plants, which reside at the bottom of the food web and support commercially important fisheries.

Seawater becomes more acidic when atmospheric carbon dioxide ( $\text{CO}_2$ ) absorbed by the water is converted into carbonic acid. The acidity of oceans is changing very rapidly. The hydrogen ion concentration of surface ocean water (a reflection of pH) is now about 30% higher than it was 200 years ago, according to William Sunda, a research chemist at the National Oceanic and Atmospheric Association in Beaufort, North Carolina, while atmospheric concentrations of  $\text{CO}_2$  have risen by about 38%. Most of the research focus has been on how ocean acidification negatively impacts marine creatures, such as mollusks and corals, that form shells or exoskeletons from calcium carbonate [EHP 116:A292–A299 (2008)]. Little attention has been paid to how increasing acidity changes the chemistry and biological availability of essential nutrients such as iron.

In the current study, Dalin Shi, Francois M. M. Morel, and colleagues at Princeton University measured the uptake of iron in *Thalassiosira weissflogii*, *Thalassiosira oceanica*, *Phaeodactylum tricornutum*, and *Emiliana huxleyi*. As the researchers lowered the pH of model laboratory culture media from 8.6 to 7.7, they observed a significant decrease in the rate of iron uptake by all species. A similar trend occurred when laboratory phytoplankton were placed in natural seawater collected off the New Jersey coast and the open ocean near Bermuda. The average iron uptake rate decreased by 10–20% between the highest- and lowest-pH conditions in natural seawater. “The average pH of



ocean water today is 8.08,” says Shi, a graduate student in oceanography.

Much of the iron in ocean water is strongly bound to natural organic chelators, such as siderophores, which bind and release iron in different ways. The research team examined the effect on iron uptake of 3 chemically different model chelators—the synthetic chelator ethylenediaminetetraacetic acid (EDTA) and two siderophores, desferri-ferrioxamine B (DFB) and azotochelin. As the pH dropped, iron availability was dramatically reduced by EDTA and moderately reduced by DFB, but was unchanged by azotochelin.

Little is known about how marine ligands bind and release iron in seawater. The model chelator findings “show in principle that lowering pH can decrease iron present for biological use, depending on the chelator. And the results with natural seawater show this also occurs with natural chelators,” says Sunda.

One conceivable consequence of limited iron due to ocean acidification could be a decline in phytoplankton populations, resulting in reduced fish harvests for human consumption, according to Morel, a professor of geosciences. “But this is all speculation,” he cautions. “The only thing we documented is a decrease in the bioavailability of dissolved iron in four laboratory organisms.”

Phytoplankton species perform almost all marine photosynthesis, a biochemical process that requires iron to convert  $\text{CO}_2$  from air into

organic matter and oxygen. Some of this organic matter sinks, carrying carbon into the deep oceans; calculations by Josep D. Canadell and colleagues in the 20 November 2007 issue of *Proceedings of the National Academy of Sciences* estimate this “carbon pump” has absorbed about a quarter of the  $\text{CO}_2$  emitted by human activities. A decrease in iron availability through ocean acidification could restrict this carbon pump, resulting in an increase in atmospheric  $\text{CO}_2$ , notes Sunda.

On the other hand, marine organisms may evolve their own nutritional coping strategies. For instance, Sunda and colleagues, recently discovered that members of the bacterial genus *Marinobacter*, which live in close contact with phytoplankton that cause harmful algal blooms, produce a novel siderophore that tightly binds iron in the dark. But when exposed to sunlight, the siderophore breaks down and releases an unbound form of iron that the phytoplankton readily take up to drive photosynthesis. The relationship is mutually beneficial; when the *Marinobacter* and phytoplankton species are grown separately, both grow poorly compared with when they grow together. “Nature is incredibly clever when it comes to obtaining scarce nutrients,” says Sunda, whose work was described in the 6 October 2009 issue of the *Proceedings of the National Academy of Sciences*.

Carol Potera, based in Montana, has written for EHP since 1996. She also writes for *Microbe*, *Genetic Engineering News*, and the *American Journal of Nursing*.



## CHILDREN'S HEALTH

## Secondhand Smoke Exposure May Alter Fetal Blood Pressure Programming

Babies born to mothers who smoke cigarettes may be at risk for abnormal blood pressure and heart rate control at birth, suggests research published in the March 2010 issue of *Hypertension*. The results of the new study further hint that this control may become worse as exposure to secondhand smoke continues, perhaps increasing the risk of developing hypertension in later life.

The study compared the heart rate and blood pressure control of 19 infants born to non-smokers with those of 17 infants whose mothers reported smoking an average of 15 cigarettes per day before and after giving birth. The resting blood pressure of the infants in both groups followed essentially the same developmental trend over the first year of life, although the smoke-exposed infants had higher diastolic blood pressure at age 3 months. The resting heart rate of both groups also was similar and followed the same trend up to age 3 months. But by 1 year the resting heart rate of the smoke-exposed infants averaged 20% slower than that of their unexposed counterparts.

The researchers also monitored changes in heart rate and blood pressure over a span of 40 beats as the infants, sleeping soundly on tilt tables, were raised from a supine position to



Prenatal exposure to maternal smoking may have contributed to blood pressure abnormalities observed in infants.

an inclination of 60° over 5 seconds and held in that position for 1 minute. "As the body becomes more upright, the heart rate should rise temporarily, and different blood vessels should constrict to increase the blood pressure and ensure enough blood gets to the brain," explains first author Gary Cohen, a senior research scientist in the Department of Women's and Children's Health at the Karolinska Institute, Stockholm. Sure enough, that is what the authors observed for the nonexposed infants, with peak values becoming somewhat higher between 1 week and 1 year as expected.

Gary Cohen

## The Beat

by Erin E. Dooley

### Foodborne Illness Costs: No Small Potatoes for the United States

The Produce Safety Project of The Pew Charitable Trusts estimated in March 2010 that foodborne illnesses cost the United States \$152 billion each year and each citizen an average of \$1,850 per case. The report, available at [www.makeourfoodsafes.org](http://www.makeourfoodsafes.org), based its estimate on medical costs as well as costs due to lost life expectancy, pain and suffering, and functional disability. The CDC estimates more than 76 million new cases of foodborne illness resulting in 5,000 deaths and 325,000 hospitalizations occur each year in the United States.

### TSCA Information Now Free Online

The EPA announced 15 March 2010 it will now provide free online access to the Toxic Substances Control Act Chemical Substance Inventory, which provides data on thousands of industrial chemicals. Until now, this consolidated set of information was available only by purchase. The move is part of the agency's stated priority of making chemical information more accessible to the public and follows a January announcement that the EPA is seeking to reduce some confidentiality claims on the identity of chemicals (read more about chemical confidentiality on p. A168 of this issue). The inventory is available at <http://www.epa.gov/oppt/newchemicals/pubs/invntory.htm>.

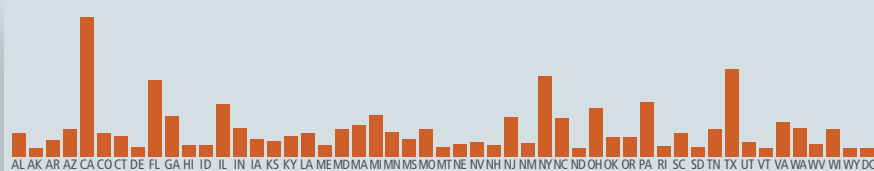


Paint and contaminated dust are major sources of lead exposure in U.S. children.

### New Lead Paint Rule Takes Effect

Effective 10 April 2010 all renovations of housing constructed before 1978 and of child-occupied facilities (such as schools) must be performed by certified renovators using specific lead-safe work practices. "Renovation" is defined broadly under the EPA rule to include window repair, weatherization, and modification of painted doors. The new regulation goes beyond earlier tenant notification stipulations by

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National Comparison of Annual Health-Related Costs of Foodborne Illness

Source: [http://www.makeourfoodsafes.org/cost\\_map](http://www.makeourfoodsafes.org/cost_map)

The exposed infants showed a similar trend over time. However, between 3 months and 1 year their responses became exaggerated, with their heart rate rising faster (and increasing by an average of 11.5% instead of the 6.5% seen in the nonexposed babies) before falling more quickly. Their diastolic blood pressure followed suit.

When the nonexposed infants were tilted and maintained upright, sustained rises in systolic, diastolic, and mean blood pressure of 2–3% were seen at age 1 week, rising to 8–10% by 1 year as expected. In contrast, in the exposed infants the increases in blood pressure were nearly double at age 1 week but failed to increase over time.

“Thus, the newborns of smokers hyperreact to positional change, but by the time they are one year old and want to stand up they are underreacting; their routine blood pressure compensation systems just don’t work properly,” says Cohen. “It would appear that neither their heart rate nor sympathetic constrictor tone [impulses from the sympathetic nervous system that help control blood vessel constriction] are properly ‘programmed’ even at birth, with things getting worse over time.”

This programming problem could lie in an overly strong sympathetic tone caused by exposure to some compound in cigarette smoke in the womb and after birth, the researchers say. This might slowly increase vascular resistance, leading to the increased diastolic blood pressure seen at rest at 3 months, and the eventual loss of sympathetic reactivity.

The authors further hypothesize that the fall in heart rate observed in exposed infants at age 1 year was an attempt to restore some kind of equilibrium. Unfortunately, this reprogramming solution appears to hinder proper positional blood pressure control, “and there is evidence this could increase the chances of hypertension later on,” explains Cohen.

In adults, cardiovascular pathophysiology can involve chronic sympathetic overactivity leading to increased blood pressure. The authors suggest something similar may be happening in the children they studied.

“[Whether these observations can be] explained by alterations in central sympathetic outflow requires further investigation as this was not directly assessed in this study,” remarks James Fisher, a lecturer in exercise physiology in the School of Sport and Exercise Sciences, University of Birmingham who was not involved in the study. “As is often the case with good research, we are left with more questions than answers. Is the altered cardiovascular reactivity specific to postural stress, or is it more generalized? What is the biological significance of the magnitude of the alteration in cardiovascular reactivity? How

**“The newborns of smokers hyperreact to positional change, but by the time they are one year old and want to stand up they are underreacting; their routine blood pressure compensation systems just don’t work properly.”**

permanent is the ‘reprogramming,’ and is it reversible if smoke exposure is withdrawn?”

Although interesting, the study is rather small. “I would like to see confirmation in a larger study,” says Mark Caulfield, director of the William Harvey Research Institute at Barts and The London School of Medicine and Dentistry, “with formal proof of cigarette consumption status in each of the study groups before drawing a firm conclusion.”

**Adrian Burton** is a biologist living in Spain who also writes regularly for *The Lancet Oncology*, *The Lancet Neurology*, and *Frontiers in Ecology and the Environment*.

requiring that renovators post warning signs at the remodeling site to inform workers and occupants of lead hazards. Contractors also must now follow lead dust containment and waste management procedures. The EPA provides more information for contractors, certification trainers, homeowners, and landlords at [www.epa.gov/getleadSAFE](http://www.epa.gov/getleadSAFE).

## UNEP Offers E-Waste Predictions, Guidance

The world’s stockpile of e-waste—discarded computers, mobile phones, and other electronic devices—is growing by an estimated 40 million tons per year with little sign of stopping. In *Recycling—From E-Waste to Resources*, released 22 February 2010, UNEP estimates the number of discarded computers shipped to some developing countries could increase by as much as 500% by 2020. The informal recycling of electronics is a lucrative but highly hazardous cottage industry in many developing countries. The UNEP report therefore offers guidance for countries to build successful and safer e-waste management systems.

## Review of Environmental Factors in Malaria’s Spread

A review by Luis Fernando Chaves and Constantianus Koenraadt in the March 2010 *Quarterly Review of Biology* assesses the factors contributing to increases in malaria cases worldwide. The researchers report that climate change, human migration, and land-use changes all are causing malaria to spread into highland areas of East Africa, Indonesia, Afghanistan, and elsewhere. They systematically show how climate affects multiple biological components of malaria transmission and highlight the need for research to better understand the transmission dynamics of this disease and how to sustainably control or eliminate it.

## PAHs: Pathways to Waterways

Polycyclic aromatic hydrocarbons (PAHs), chemicals released during combustion of biomass and fossil fuels, are ubiquitous in the environment. Lisa Rodenburg and colleagues undertook a 4-year study to identify the primary routes by which PAHs end up in New York/

New Jersey Harbor. Their findings, reported in the March–April 2010 *Journal of Environmental Quality*, show stormwater runoff was the main pathway, contributing about half the harbor’s PAH load, and atmospheric deposition was an important contributor of smaller PAH compounds. The results suggest that minimizing the flow of PAHs into waterways may require tweaking stormwater management plans to control runoff.



Stormwater runoff is a major route by which PAHs enter waterways.